

Advanced Manufacturing Technologies (AMT): Composites Integrated Modeling

Completed Technology Project (2013 - 2015)



Project Introduction

The Composites Integrated Modeling (CIM) Element developed low cost, lightweight, and efficient composite structures, materials and manufacturing technologies with direct application to the proposed Space Launch System (SLS) Exploration Upper Stage (EUS) mission.

CIM encompassed computational methods, tools and processes that go into the materials, design, manufacturing and qualification of composite aerospace structures. This effort proposed that test articles and analytical techniques be developed in order to investigate the appropriate treatment of model-based methods to achieve the maximum benefit of using the computational approaches for optimization of cost, performance, and reliability materials for launch vehicle structures such as the EUS. Materials Extend use of out-of-autoclave materials to load-bearing composite structures Introduce damage-based allowables to improve performance while reducing cost Reduce allowables variability Design Tailor composite wall construction to maximize load-carrying capability while minimizing mass Implement model-based integration of design and qualification/certification Reduce artificial knockdown factors by implementing damage-based allowables at a component level Manufacturing Implement model-based, automated manufacturing of relevant-scale structures Demonstrate light-weight bonded joint technology to reduce numbers of fasteners

Anticipated Benefits

This project was transitioned to the Composites for Exploration Upper Stage Project (CEUS) under the Technology Demonstration Program. The CEUS project will design, manufacture and test an aft upper stage LH2 tank skirt and a forward upper stage LH2 tank skirt. The two upper stage skirts will be 8.4m in diameter and tested in a relevant environment maturing the composites technology for this dry structure application to a TRL6.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

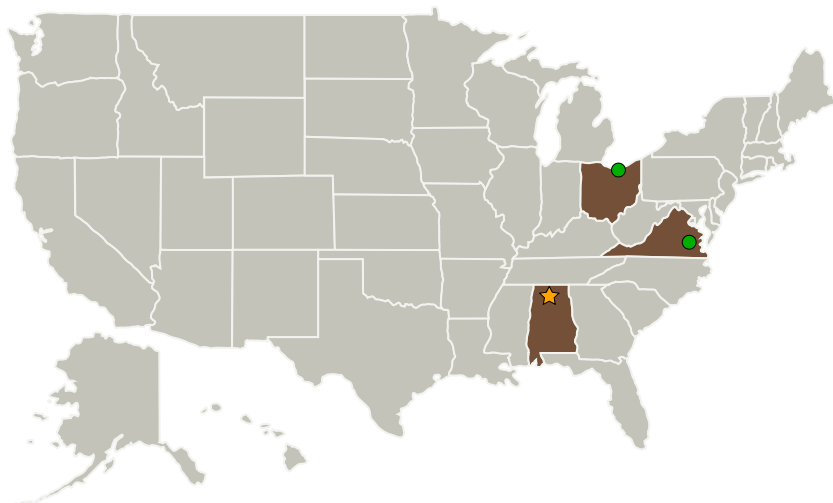
Game Changing Development

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Marshall Space Flight Center (MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
● Glenn Research Center (GRC)	Supporting Organization	NASA Center	Cleveland, Ohio
● Langley Research Center (LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations

Alabama	Ohio
Virginia	

Project Management

Program Director:

Mary J Werkheiser

Program Manager:

Gary F Meyering

Project Manager:

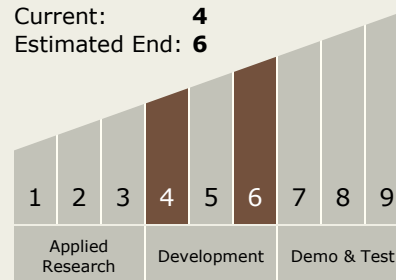
John H Vickers

Principal Investigator:

Lanetra C Tate

Technology Maturity (TRL)

Start: 4
 Current: 4
 Estimated End: 6



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - TX12.3 Mechanical Systems
 - TX12.3.1 Deployables, Docking, and Interfaces